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Evaluation of Saltstone Disposal Facility Radiological Inventory

Summary
Based on a review of the updated Saltstone Disposal Facility (SDF) inventory and the projected impact of the influent streams into Tank 50, there are 12 radionuclides that are expected to approach or have already exceeded the inventory projections established during the development of the Saltstone Performance Objective Demonstration Document (PODD). While none of the 12 radionuclides challenge the limits established in the 2005 Special Analysis (SA), an increased inventory of these radionuclides should be evaluated to determine any impact on the conclusions of applicable waste disposal documentation (i.e., the SDF Performance Assessment, 2005 SA, PODD, Savannah River Site Composite Analysis or the existing Unreviewed Disposal Question Evaluation on Vault 4 weeping).

Discussion
The radiological inventory, as of 3/31/2009, for the 64 radionuclides described in the PODD [CBU-PIT-2005-00146] was recently updated for SDF Vaults 1 and 4 [X-CLC-Z-00027]. Based on the updated inventory values, the total SDF inventory for four radionuclides, Am-243, Cm-243, U-233 and Cf-251 are either at or above the total projected inventory documented in the PODD. It should be noted that none of the exceedances are greater than five times the original inventory projection in the PODD, a trigger valued noted by the Nuclear Regulatory Commission in their SDF Monitoring Plan [ML071150165] as requiring additional review. With the exception of Cf-251, the impact of an increased inventory for these radionuclides should be evaluated. Essentially all of the total SDF inventory for Cf-251 in the PODD is attributed to the initial inventory value for Vault 4. Future additions of Cf-251 are expected to be insignificant compared to the initial inventory and the PODD value is not anticipated to be exceeded.

In addition to updating the SDF inventory, a best estimation of the upcoming additions to Tank 50 and the impact they will have on the SDF radionuclide inventory in comparison to the PODD inventory projections [LWO-LWE-2009-00154] and projected radionuclide concentrations

[LWO-LWE-2009-00159] was also performed. The evaluation estimates the total additional curies that will be added to the SDF inventory from processing all of Salt Batch 2 (i.e., current Tank 49 contents) and Effluent Treatment Project (ETP), Canyon low-level waste streams and Tank 23 influents through the 3rd quarter of calendar year 2009. Not including Am-243, Cm-243 and U-233, this evaluation shows 12 radionuclides that may exceed 50% of the PODD projected value after this material is disposed of in SDF. These radionuclides are Nb-94, Th-230, Cs-135, Ra-226, Pr-144, Ce-144, Ni-59, Pu-242, U-232, U-234, U-235 and U-236. With the exception of Ra-226, U-234 and U-235, the impact of an increased inventory for these radionuclides should be evaluated. For U-234 and U-235, the majority of the total SDF inventory in the PODD is attributed to the initial inventory value for Vault 4. The amount of additional inventory being added for these two radionuclides is estimated to be relatively small (i.e., less than 5%). The Ra-226 inventory values can be attributed to the characterization associated with Tank 23 which is based on sample analysis at minimum detection limits. The PODD value for these three radionuclides is not anticipated to be exceeded.

Conclusion

Based on a review of the updated SDF inventory and the projected impact of the influent streams into Tank 50, the following 12 radionuclides are expected to approach or have already exceeded the inventory projections established during the development of the PODD:

Am-243	Pr-144
Ce-144	Pu-242
Cm-243	Th-230
Cs-135	U-232
Nb-94	U-233
Ni-59	U-236

While none of the 12 radionuclides challenge the limits established in the 2005 SA [WSRC-TR-2005-00074], an increased inventory of these radionuclides should be evaluated to determine any impact on the conclusions of the SDF Performance Assessment [WSRC-RP-92-1360], 2005 SA, PODD, Savannah River Site Composite Analysis [WSRC-RP-97-311] or the existing Unreviewed Disposal Question Evaluation on Vault 4 weeping [SRS-REG-2007-00041]. Although it is not anticipated that the inventories would reach this value, it is recommended that an increased inventory of 50 times the total projected PODD value for these radionuclides be evaluated. The 50 times increase will provide at least one order of magnitude increase over the current inventory for the 12 radionuclides being evaluated.

References

CBU-PIT-2005-00146, *Saltstone Performance Objective Demonstration Document (U)*, Revision 0, June 2005.

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LWO-LWE-2009-00159, *Best Estimation of the Concentration of Radionuclides in a Tank 50 Influent Stream Aggregate,* Revision 0, June 2009.

ML071150165, *U.S. Nuclear Regulatory Commission Plan for Monitoring the U.S. Department of Energy Salt Waste Disposal at the Savannah River Site in Accordance with the National Defense Authorization Act for Fiscal Year 2005*, May 2007.

SRS-REG-2007-00041, *Unreviewed Disposal Question Evaluation: Evaluation of Liquid Weeping from Saltstone Vault 4 Exterior Walls*, Revision 1, April 2008.

WSRC-RP-92-1360, *Radiological Performance Assessment for the Z-Area Saltstone Disposal Facility*, Revision 0, December 1992.

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